Numerical Analyses for Cardiovascular Problems with Risk Assessments

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ABSTRACT

We present numerical simulations and visualizations related to cardiovascular problems such as aortic aneurysms, which are one of the life-threatening diseases. However, natural history of the development of an aneurysm has not been fully understood[1,2]. Several mathematical viewpoints play important roles for understanding the mechanisms and pathologies of such diseases. In this study, morphological characterization of blood vessels, which has wide variety among individuals, is introduced. Differences in the morphology of the vessels bring about differences in the flow characteristics, which lead to different wall shear stresses (WSS) and oscillatory shear index (OSI) distributions. We consider patient-specific aorta models constructed from CT scans. We compute the flow field with the variational multiscale version of the Deforming-Spatial-Domain/Stabilized Space–Time method (DSD/SST-VMST)[3,4]. Through the close collaborations with medical doctors, these results are used for risk assessments.

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